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NEWS

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World's Fastest Supercomputer Combination Unveiled For National Security at Lawrence Livermore Laboratory

Pair to be used to ensure U.S. nuclear weapons stockpile is safe and reliable without testing

LIVERMORE, CA -- The National Nuclear Security Administration (NNSA) today officially dedicated two new, next-generation supercomputers that will help ensure the U.S. nuclear weapons stockpile remains safe and reliable without nuclear testing. The IBM machines will be housed at Lawrence Livermore National Laboratory (LLNL).

NNSA Administrator Linton F. Brooks said the dedication marks the culmination of a ten-year campaign to use supercomputers to run three-dimensional codes at lightning-fast speeds to achieve much of the nuclear weapons analysis that was formerly accomplished by underground nuclear testing.

At an event in the LLNL Terascale Simulation Facility (TSF), Brooks also announced that the BlueGene/L supercomputer performed a record 280.6 trillion operations per second on the industry standard LINPACK benchmark. The supercomputing community uses the LINPACK benchmark application as the measure of performance to determine rankings on the Top 500 computer list. (For more information on the Top 500 list, see http://www.top500.org/)

Purple, the other half of the most powerful supercomputing twosome on Earth, is a machine capable of 100 teraflops as it conducts simulations of a complete nuclear weapons performance. The IBM Power5 system is undergoing final acceptance tests at the TSF.

"The unprecedented computing power of these two supercomputers is more critical than ever to meet the time-urgent issues related to maintaining our nation's aging nuclear stockpile without testing," Brooks said. "Purple represents the culmination of a successful decade-long effort to create a powerful new class of supercomputers. BlueGene/L points the way to the future and the computing power we will need to improve our ability to predict the behavior of the stockpile as it continues to age. These extraordinary efforts were made possible by a partnership with American industry that has reestablished American computing preeminence."

In a recent demonstration of its work capability, BlueGene/L ran a record-setting materials science application at 101.5 teraflops sustained over seven hours on the machine's 131,072 processors, running an application of importance to NNSA's effort to ensure the safety and reliability of the nation's nuclear deterrent. A teraflop is 1 trillion computer operations per second.

Both machines were developed through NNSA's Advanced Simulation and Computing (ASC) program and join a series of other supercomputers at Sandia and Los Alamos national laboratories dedicated to NNSA's Stockpile Stewardship effort to maintain the nation's nuclear deterrent through science-based computation, theory and experiment.

Together, the Purple and BlueGene/L systems will put an astounding half of a petaflop, or half of a quadrillion (1,000,000,000,000,000) operations per second, peak performance at the disposal of scientists and engineers working at Sandia, Los Alamos, and Lawrence Livermore national laboratories. This is more supercomputing power than at any other scientific computing facilities in the world.

"Today marks another important milestone in the DOE Office of Science and NNSA partnership to revitalize the U.S effort in high-end computing," said Dr. Raymond L. Orbach, director of the Department of Energy's Office of Science. "NNSA and the Office of Science have leveraged resources in the areas of operating systems, systems software and on advanced computer evaluations to the benefit of both organizations. The ASC Purple and BlueGene/L machines at Livermore are the latest in an increasingly sophisticated suite of supercomputers across the DOE complex. Together the NNSA and Office of Science high performance computing programs serve to advance U.S. energy, economic and national security by accelerating the development of new energy technologies, aiding in the discovery of new scientific knowledge, and simulating and predicting the behavior of nuclear weapons."

"The partnership between the National Nuclear Security Administration, Lawrence Livermore National Laboratories and IBM demonstrates the type of innovation that is possible when advanced science and computing power are applied to some of the most difficult challenges facing society," said Nick Donofrio, IBM executive vice president for innovation and technology. "Blue Gene/L and ASC Purple are prime examples of collaborative innovation at its best -- together, we are pushing the boundaries of insight and invention to advance national security interests in ways never before possible."

"The early success of the recent code runs on BlueGene/L represents important scientific achievements and a big step toward achieving the capabilities we need to succeed in our stockpile stewardship mission," said Michael Anastasio, LLNL's director. "BlueGene/L allows us to address computationally taxing stockpile science issues. And these code runs provide a glimpse at the exciting and important stockpile science data to come."

The 101 teraflop record-setting materials science calculations referred to above, involved the simulation of the cooling process in a molten uranium actinide system, a material and process of importance to stockpile stewardship. This was the largest simulation of its kind ever attempted and demonstrates that BlueGene/L's architecture can operate with real-world applications. The record breaking 101 teraflop number is also significant because it was sustained over a long period of time and involved a scientific code that will be one of the workhorse codes running on the machine.

BlueGene/L will move into classified production in February 2006, to address critical problems of materials aging. The machine is primarily intended for stockpile science molecular dynamics and turbulence calculations. High peak speed, superb scalability for molecular dynamics codes, low cost and low power consumption make this an ideal solution for this area of science.

Purple consists of 94 teraflop classified and 6 teraflop unclassified environments together totaling 100 teraflops. It represents the culmination of 10 years work by the ASC program to develop a computer that could effectively run newly developed 3D weapons codes needed to simulate complete nuclear weapons performance. The machine's design or "architecture" with large memory powerful processors and massive network bandwidth is ideal for this purpose. The insights and data gained from materials aging calculations to be run on BlueGene/L will be vital for the creation of improved models to be used for future full weapons performance simulations on Purple.

The systems are part of an approximately $200 million contract with IBM and were delivered on schedule and within budget. The machines were designed to meet requirements in weapons simulations and materials science. The approach of dividing requirements across two machines, rather than building a single machine to meet all requirements, turned out to be the efficient and cost effective way to meet program objectives.

Established by Congress in 2000, NNSA is a semi-autonomous agency within the U.S. Department of Energy responsible for maintaining and enhancing the safety, security, reliability and performance of the U.S. nuclear weapons stockpile without nuclear testing; working to reduce global danger from weapons of mass destruction; providing the U.S. Navy with safe and effective nuclear propulsion; and responding to nuclear and radiological emergencies in the U.S. and abroad. For more information, visit www.nnsa.doe.gov.

Founded in 1952, Lawrence Livermore National Laboratory has a mission to ensure national security and to apply science and technology to the important issues of our time. Lawrence Livermore National Laboratory is managed by the University of California for the U.S. Department of Energy's National Nuclear Security Administration. For more information, visit www.llnl.gov/PAO.

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